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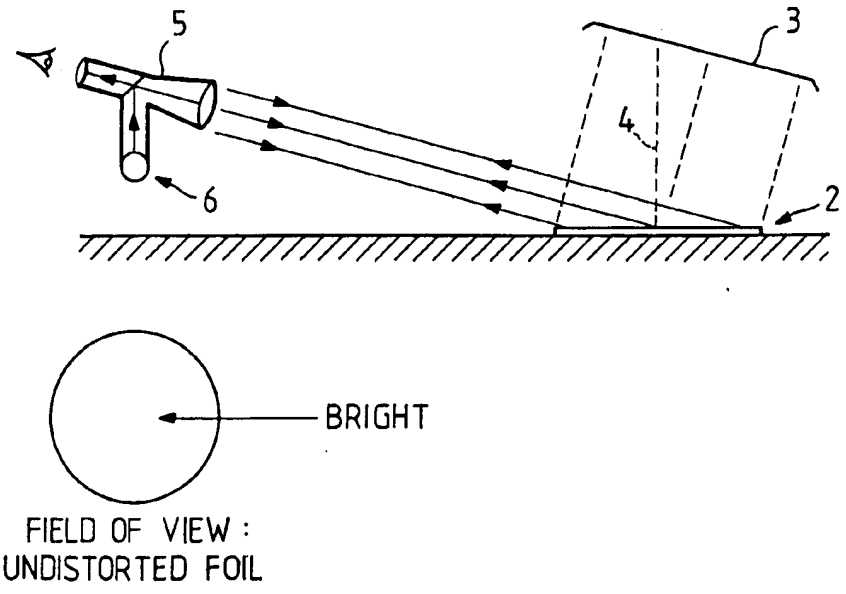
(54) Intruder detection system

(57) An intruder detection system uses one or more sheets of obliquely reflective foil on the ground in the region to be protected. Such foil consists of an aluminium foil whose surface is covered with a dense columnar structure of inclined spinules. Light incident on the foil aligned with the spinules is reflected very little if at all, while light at right angles to the length of the spinules is reflected.

As used in the present system light from a source (6) is directed along the normal to the pseudo-surfaces (indicated at 3) defined by the spinules, which light is reflected back to the viewer. If an intruder passes the distortion to the foil distorts some at least of the pseudo-surfaces, which reduces the amount of light reflected back. This reduction is readily detectable. The light source can be an infra-red source, in which case detection uses an infra-red detector-alarm arrangement.

Fig.1.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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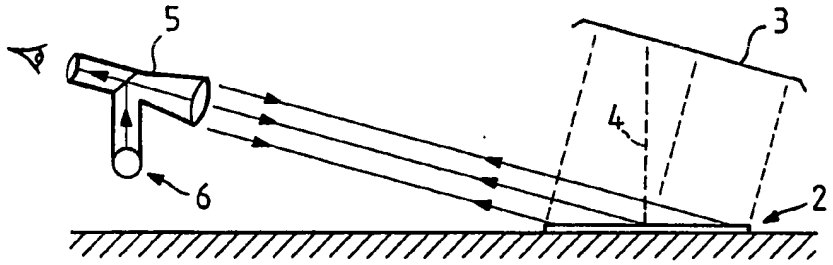
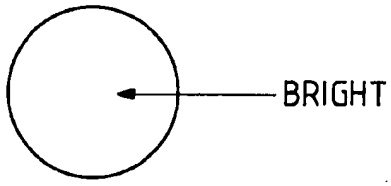
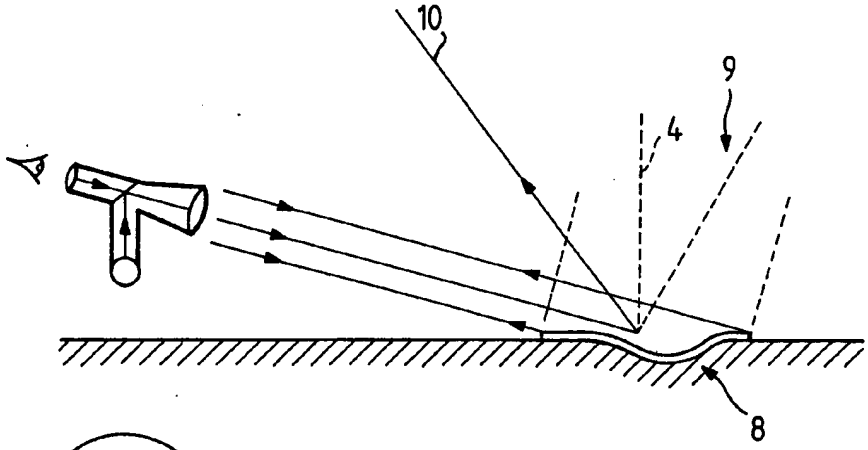
Fig.1.

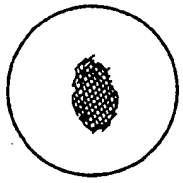




FIELD OF VIEW :
UNDISTORTED FOIL

Fig.2.





FIELD OF VIEW :
LOCALLY DISTORTED FOIL

SPECIFICATION

Intruder detection system

The present invention relates to an intruder detection system in which the fact that an intruder has walked across a protected area is revealed, possibly at a time subsequent to the event.

Such systems often rely on movable devices such as flat switches under a floor surface such as a carpet, and are in many cases readily detectable and hence avoidable by an intruder. An object of the invention is to produce such a system in which the above disadvantage is at least minimised.

According to the present invention there is provided an intruder detection system, which include a layer of an obliquely-reflective foil on the ground in a region to be protected, a light source so located as to aim a light beam along the normal to the pseudo-surfaces provided by the foil, and a light receiver for light reflected from said pseudo-surfaces, wherein the passage of an intruder distorts the foil so as to distort some of the pseudo-surfaces, which distortion diverts some of the incident light so that the light reflected to the receiver is reduced in intensity.

An embodiment of the invention will now be described with reference to the accompanying drawing in which *Figure 1* and *Figure 2* illustrate schematically an arrangement embodying the invention.

The obliquely-reflective material used, which is referred to as oblique foil, is an aluminium foil on the surface of which a dense array of minute columnar "spinules" of aluminium is grown, each spinule leaning at approximately the same angle to the geometrical normal to the foil. This material when viewed optically in some directions looks sooty black and in other directions looks silvery grey. This is somewhat crudely explained on the basis that light incident in directions parallel to the spinules gets lost in the interstices between them, e.g. by multiple reflection from their sides. However, light incident at right angles to the spinules' angle of slant 'sees' an array of tiny reflectors. Thus the optical effect of the foil is rather like an inefficient mirror in the direction normal to the spinules' angle of slant, hence the silvery grey appearance, while in other directions it is almost a non-reflector.

Although the material at present used is an aluminium foil it is possible to produce such oblique foils from other reflective metals. In fact it is possibe to place a homogeneous layer of another metal on top of the columnar structure. Thus a thin layer of copper permits the foil to reflect light even in the critical direction parallel to the spinules. In this direction the foil appears copper-coloured, but at the critical angle it continues to appear silvery. Other colours, e.g. blue and green, can be obtained using such materials as tantalum.

The foils used in the present invention can be prepared in the manner described in our Application No. 8025963 (M.P. Drake 11X), which describes the production of foils of valve metal (e.g. aluminium). In that application the intended use of the foils thus made is as electrodes for electrolytic capacitors, where the large surface area due to the spinules is valuable. Other aspects of the production of such foils are described in our Application No. 8137227 (M.P. Drake - D.W. Hazeldean 14-7), where the foils are made for certain optical application such as solar absorbers.

When oblique foil is used for intruder detection, a sheet of the material with an inclined pseudo-normal (i.e. the normal to the reflective surface relative to the physical normal) is spread horizontally on the ground across the threshold such that an intruder has to tread on it and distort it, e.g. by denting or crushing. The foil is examined using a viewer from a point on one side which lies on the pseudo-normal. Hence if a light beam is used there is considerable back-reflection. Any disturbance of the foil reduces or even eliminates this reflection from the distorted area and is readily detectable.

Thus in Figure 1 we see a floor surface 1 with a region 2 of oblique foil. The angle of slant of the pseudo-surface formed by the spinules is indicated by the broken lines 3. The line 4 indicates the physical normal of the material in its rest condition. At one side there is a viewer 5 with a light source 6 "aimed" at a half-silvered mirror. This source thus directs a beam at the foil 2, which is reflected back as shown, and can thus be viewed optically. The inset to Figure 1 indicates what is actually seen.

Figure 2 shows what happens when the foil is distorted by the passage of an intruder. Here we see a depression 8 caused by an intruder's feet, which produces a locally distorted pseudo-surface as indicated at 9. Hence some of the incident light is deflected as indicated at 10, so the light returning to the viewer is of reduced intensity as indicated by the inset 6 Figure 2.

Such an arrangement preferably uses infra-red incident radiation, in which case the viewer is an infra-red detector connected to an alarm. In such case the foil is more easily concealed, e.g. by being coated with a material opaque to visible but not infra-red radiation. This material's colour can be chosen to be similar to that of the normal floor covering.

An advantage of the above described arrangement is that an alarm based on oblique foil would be much less likely to be set off by an office cat than is the case for some other alarm system.

CLAIMS

1. An intruder detection system, which includes a layer of an obliquely-reflective foil on the ground in a region to be protected, a light source so located as to aim a light beam along the normal to the pseudo-surfaces provided by the foil, and a light receiver for light reflected from said pseudo-surfaces, wherein the passage of an intruder distorts the foil so as to distort some of the pseudo-surfaces, which distortion diverts some of the incident light so that the light reflected to the receiver is reduced in intensity.

2. A system as claimed in claim 1, and in which the light source supplies infra-red light, the receiver being an infra-red detector which controls an alarm.

3. A system as claimed in claim 1 or 2, and in

which the light source and the receiver are co-located, the light source directing its beam on to a half-silvered mirror from which it is reflected along said normal, the half-silvered mirror passing the light reflected back from the foil.

4. A system as claimed in claim 1, 2 or 3, and in which the obliquely-reflective foil is an aluminium foil with a dense covering of minute columnar spinules of aluminium.

5. An intruder detection system, substantially as described with reference to the accompanying drawing.

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